Préhistoires Méditerranéennes

Colloque | 2014
Fonctions, utilisations et représentations de l'espace dans les sépultures monumentales du Néolithique européen

Newly recorded Neolithic earthen long barrows in south-western Poland: unexpected discoveries, expanded perspectives, new interprétations

Nouvelles attestations de longs tumulus de terre néolithiques dans le sud ouest de la Pologne : découvertes inattendues, perspectives élargies, nouvelles interprétations

Agnieszka Przybył

Édition électronique
URL : http://journals.openedition.org/pm/996
ISSN : 2105-2565

Éditeur
Association pour la promotion de la préhistoire et de l'anthropologie méditerrannéennes

Référence électronique
Agnieszka Przybył, « Newly recorded Neolithic earthen long barrows in south-western Poland: unexpected discoveries, expanded perspectives, new interprétations », *Préhistoires Méditerranéennes* [En ligne], Colloque | 2014, mis en ligne le 07 janvier 2015, consulté le 01 mai 2019. URL : http://journals.openedition.org/pm/996

Newly recorded Neolithic earthen long barrows in south-western Poland: unexpected discoveries, expanded perspectives, new interprétations

Nouvelles attestations de longs tumulus de terre néolithiques dans le sud ouest de la Pologne : découvertes inattendues, perspectives élargies, nouvelles interprétations

Agnieszka Przybył

1 *In loving memory of my friend Magdalena S. Midgley*

2 ***Résumé Long*** (*traduction : Karim Gernigon*)
Les longs tumulus de terre de la culture des gobelets en entonnoir, de même que les structures mégalithiques, représentent l'un des plus spectaculaires phénomènes culturels du Néolithique et ont de ce fait attiré depuis longtemps l'attention des chercheurs. Grâce à cela, ils sont aujourd'hui assez bien reconnus et documentés mais beaucoup n'ont hélas pas été conservés jusqu'à notre époque. Dans ces conditions, est-il encore possible de découvrir des monuments néolithiques intacts, qui seraient restés inconnus jusqu'à ce jour ? Et si oui, de telles découvertes peuvent-elles apporter de nouvelles données qui changeraient significativement notre regard sur le passé ? Cet article montre justement que l'utilisation de nouvelles techniques de prospection non invasives, à la différence des méthodes habituelles (telles que les recherches par prospections de surface, par géomagnétisme et par la fouille), permet non seulement de découvrir des monuments inconnus auparavant, mais ouvre aussi de nouvelles perspectives de recherches, et crée ainsi de nouvelles possibilités d'interprétation des phénomènes liés à la tradition funéraire monumentale. C'est ce que montre l'histoire des découvertes de tumulus dans la forêt proche du village de Muszkowice sur le piémont des Sudètes (Basse Silésie, sud-

ouest de la Pologne) : elle a commencé par la découverte fortuite d'une nécropole et a abouti à l'identification, grâce à la mise en œuvre d'une prospection non invasive à large échelle, d'un complexe étendu de plusieurs nécropoles monumentales.

3 La première nécropole néolithique, désignée sous le nom de Muszkowice site 18 et comprenant 6 longs tumulus de terre, a été découverte fortuitement en 1995. Cette découverte a surpris les spécialistes du Néolithique, car ils pensaient qu'il n'existait aucun vestige de tradition funéraire monumentale sur les plateaux du sud-ouest de la Pologne. La première étape de reconnaissance de la nécropole, conduite de 2001 à 2006 puis en 2010 et 2011, mise en œuvre par des méthodes de recherche traditionnelles, a apporté des informations sur l'organisation spatiale de la nécropole, les règles de construction des tumulus fouillés ainsi que sur les activités accompagnant les rituels funéraires. Des échantillons pour de futures analyses ont aussi été prélevés afin de disposer des moyens de préciser la chronologie des tumulus de Muszkowice. Cette étape de la recherche s'attacha à analyser les présomptions qui incitaient les archéologues à considérer les longs tumulus de terre comme devant être absents des piémonts des Sudètes. Malgré cela, les indices en faveur de ces présomptions étaient si forts que la nécropole a été considérée par beaucoup comme une manifestation unique et isolée de la tradition funéraire monumentale dans cette région. C'est seulement la seconde étape des recherches, mises en œuvre en 2012 avec l'utilisation de nouvelles techniques non-invasives (parmi elles le scan aérien laser LIDAR) qui montra que le site de Muszkowice 18 n'était pas dans ce secteur un exemple isolé de nécropole monumentale KPL. Sur le terrain relativement réduit du complexe forestier ont été localisées jusqu'à 15 nécropoles, comprenant 20 longs tumulus de terre supplémentaires. Ces nouvelles données ont été analysées à l'aide d'outils de la gamme des systèmes d'information géographiques (SIG), dans le but de reconnaître les conditions environnementales de localisation des longs tumulus et d'estimer leur contexte paysager.

4 La mise en œuvre de nouvelles techniques de détection non invasives a fondamentalement modifié la perspective spatiale des observations effectuées : d'abord limitées à l'espace restreint d'un site isolé, elles couvrent désormais l'ensemble de la région présentant plusieurs nécropoles néolithiques. Grâce à cet élargissement du champ d'observation, les perspectives de recherche ont pu elles aussi se développer, ce que montre la dernière partie de l'article. On y insiste sur le fait que, en dépit des affirmations antérieures des chercheurs travaillant sur la problématique des traditions funéraires monumentales en Europe, les observations faites à Muszkowice ont montré que tout le complexe de nécropoles a été implanté sur de fertiles terrains loessiques, et donc pas en périphérie mais au centre de territoires intensivement occupés au Néolithique ancien par les sociétés danubiennes. L'absence soulignée auparavant de ce type de monument sur des terrains clefs pour les premières sociétés agro-pastorales résultait donc de l'état de la recherche et pas d'un abandon effectif de la construction de nécropoles par les sociétés KPL établies localement sur le piémont des Sudètes. On peut donc affirmer que l'un des résultats importants des recherches effectuées à Muszkowice est d'attirer l'attention des chercheurs sur la nécessité de considérer une aire de répartition spatiale des longs tumulus de terre bien plus large que ce qui était estimé auparavant. Les découvertes de Basse Silésie ont montré indubitablement que l'idée de construire des monuments s'est diffusée depuis la plaine nord-européenne, non seulement en direction de l'Europe du Nord, mais également, ce qui se voit ici très clairement, vers les terrains loessiques situés au sud de celle-ci et auparavant non considérés par les chercheurs.

5 Une autre conséquence de l'obtention de cet ensemble de nouvelles données, grâce à la large échelle des recherches non invasives, a été le changement de perspective de l'observation. La mise en œuvre effective, lors des analyses menées à Muszkowice, d'outils statistiques SIG a permis d'apporter une réponse à la question du contexte paysager. Il s'agissait de savoir si les monuments de Basse Silésie représentaient la tradition funéraire monumentale d'Europe centrale ou alors une variante locale, qui aurait eu un lien avec la tradition des tumulus KPL connus plus au sud en Moravie (République Tchèque). Une courte analyse comparative avec les monuments moraves confirma finalement que les monuments de Muszkowice représentent bien le type de monuments connu en Couyavie et caractéristique des terrains situés au nord de la Basse Silésie. Il semble que la tradition d'ériger de longs tumulus de terre sur les terrains des piémonts des Sudètes soit parvenue sous une forme à peine modifiée depuis celle représentée par les tumulus de Couyavie. Par contre les tumulus KPL ovales de Moravie représentent des types fortement modifiés en comparaison avec les modèles originaux de la plaine nord-européenne et constituent probablement une réminiscence lointaine des traditions funéraires monumentales.

6 Les nouvelles découvertes de Muszkowice ont montré que l'usage des nouvelles avancées techniques permet de réaliser des découvertes inespérées, qui peuvent significativement changer notre vision des questions des phénomènes culturels globaux du Néolithique. Ces résultats montrent également que les recherches menées en usant plusieurs méthodes complémentaires apportent les résultats les plus fructueux, changeant les perspectives de recherche et influençant réellement les interprétations effectuées.

Introduction

7 Not unlike megalithic structures, earthen long barrows of the Funnel Beaker culture (FBC) rank among the most spectacular cultural phenomena of the Neolithic. Their monumental form has long compelled the attention of researchers, prospectors and observers alike. The great interest in long barrows, which spans over two centuries in Central Europe, has led to their being well recognised and documented. However, this widespread popularity among generations of enthusiasts has also paradoxically hastened their demise and many have been subject to partial or complete destruction. Is it, nonetheless, possible that there might exist undamaged Neolithic monuments still waiting to be discovered? If so, could such discoveries provide us with data so unprecedented as to significantly alter our understanding of the past? This article shows that, in contrast to standard methods of archaeological research (such as surface survey, excavation and geophysical examination), modern methods of non-invasive prospection not only open up a unique opportunity to discover as yet unknown features but also offer previously unavailable research perspectives, thus creating new possibilities for interpreting phenomena associated with the monumental funerary tradition. This will be achieved by outlining the most recent history of the barrows discovered near the village of Muszkowice located in the Sudeten Foreland (Lower Silesia, south-western Poland), from the moment a single cemetery was accidentally found in the forest, to a startling discovery, made by the use of large-scale non-invasive prospection, of an extensive complex comprising a total of over a dozen monumental cemeteries (see Przybył s.p.).

8 The paper is structured so as to clearly demonstrate how much new data was brought to light by each consecutive stage of the study. Part 2 provides background to the case study

by summarising the history of research conducted first at the earliest-found cemetery, named Muszkowice 18, and then within the whole complex. Part 3 describes the methods used in the two stages of research and their results: Part 3.1 briefly characterises stage one, which comprised the study of a single Muszkowice site carried out by the use of standard methods of archaeological examination, while stage two – the main body of research discussed in this article, which consisted of non-invasive study of the whole area – is described in greater detail in Part 3.2. This is intended to illustrate that, even following a very fruitful examination of a site, conducted by the use of surface survey, excavation and geomagnetic prospection methods, the employment of modern methods of non-destructive prospection – such as light detection and ranging (LIDAR), also called airborne laser scanning (ALS) – is still able to deliver unexpected results that may significantly further our understanding of the past. In the case of Muszkowice, they led to the discovery of multiple unknown features and produced data that made unique research perspectives available; these, in turn, allowed us to advance a new interpretation of already well-known cultural phenomena of the Neolithic (presented in Part 4).

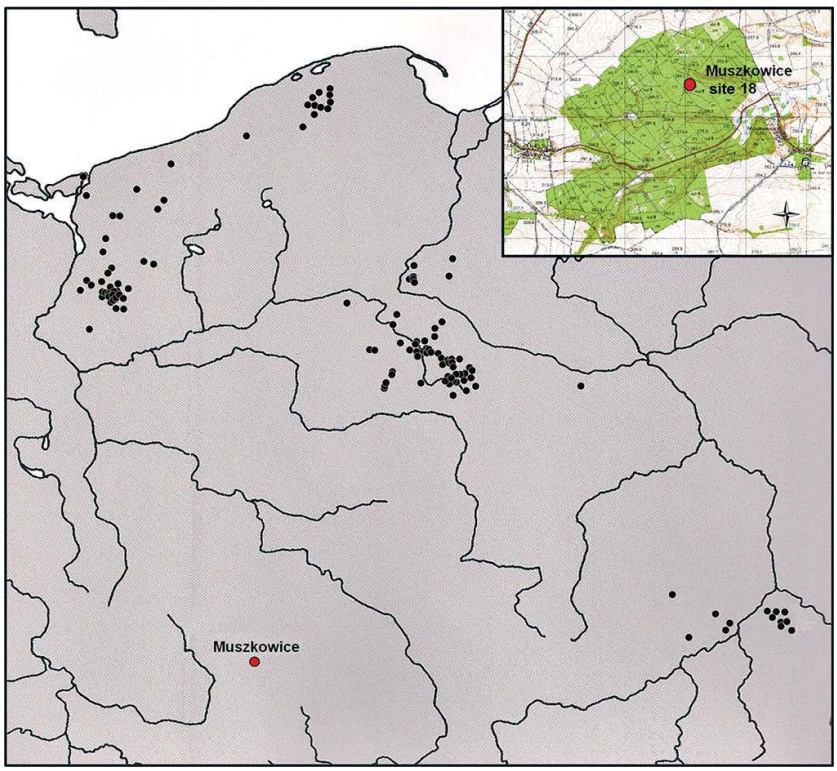
Archaeological background

9 In 1995 a cemetery was accidentally discovered in the Muszkowice Forest (recorded as site Muszkowice 18) that soon proved to comprise six earthen long mounds. The discovery caused a big commotion among the researchers of the Neolithic because it ran contrary to the previously held belief that no remains of the monumental funerary tradition existed in south-western Poland. This conviction was based on the fact that long barrows were erected mainly by the representatives of the Eastern Group of the FBC, a group which emerged and functioned in the lowlands of central Poland. The conviction was additionally supported by a number of arguments:

- As was then believed, this particular type of monument "occur[ed] predominantly in the zone of glacial outwash sands, running across the North European Plain north of the loess" (Sherratt 1990: 159) and on sparse enclaves of boulder clay and also boulder clay overlain with sand (Midgley 1985: 32–43), whereas the area under discussion is covered by loess soils that are naturally devoid of erratic stones, the primary building material of mounds;
- The site in Muszkowice lies at a considerable distance from earthen long mounds recorded in central Poland; to illustrate, the closest monuments of this type are located over 200 km to the north (fig. 1);
- It was assumed that, even though they were related to the Eastern Group, the representatives of the Lower Silesian FBC communities discontinued the tradition of building long barrows and developed a new, distinct model of culture. This change was claimed to have generated cultural differences that are still visible in archaeological material (see Bukowska-Gedigowa 1975, Kulczycka-Leciejewiczowa 1993, Wiślański 1979, Wojciechowski 1981, 1991) and are manifested in the form of strong southern influences coming, *inter alia*, from Moravia, an area characterised by a different type of mound (cf. Šmíd 2003).

1. Location of site18 in the Muszkowice Forest and on the map showing other Polish sites with mounds of the Kujavian type

(Agnieszka Przybył, after Rzepecki 2011)



10 The assumptions mentioned above supported the widely accepted view that interpreted the absence of monumental cemeteries in south-western Poland as a characteristic that distinguished the funeral traditions of the Lower Silesian FBC communities from those cultivated by other regional groups inhabiting the North European Plain. Furthermore, given the similarities in the material cultures of the local FBC group and groups from Moravia, it was expected that, in the unlikely event of any mounds being found in Lower Silesia, they would be representative of the Moravian type of mound.

11 Those long-standing views were challenged as early as stage one of the research, initiated soon after the cemetery was unexpectedly discovered in the Muszkowice Forest. However, perhaps owing to the fact that the above-mentioned assumptions had been rather deeply rooted within archaeological thought, the original line of interpretation held fast even despite the new data to the contrary. As a result, the newly discovered cemetery was considered an exception – a single and most probably isolated expression of the monumental tradition in that region (Cholewa *et al.* 2003, Wojciechowski & Cholewa 2006, 2011, Wojciechowski *et al.* 2002, Rzepecki 2011, fig. 67, N° 74).

12 Stage two of the study was carried out by the use of modern non-invasive methods. In recent years, the dynamic development of the most advanced techniques of remote sensing and methods for acquiring elevation data (including LIDAR/ALS) has allowed researchers to perform large-scale prospection of territories partly or totally unavailable to traditional and standard methods of archaeological examination, e.g. dense woodlands (Cowley 2011, Crow [2012], Crow *et al.* 2007, Crutchley & Crow 2010, Devereux *et al.* 2005, Doneus & Briese 2011, Doneus *et al.* 2008, Opitz & Cowley 2013). A selected area of the Muszkowice Forest was scanned by the use of ALS techniques, yielding startling results. Much to the researchers' surprise, rather than an accidental and isolated manifestation of the FBC funerary tradition, the cemetery at the site of Muszkowice 18 proved to be merely one of a complex of 16 monumental cemeteries, located in the relatively small

forested area of approximately 850 ha, comprising a total of no fewer than 26 earthen long mounds (cf. Przybył s.p.). As a consequence, a breadth of new data was obtained, allowing the researchers to carry out a range of additional analyses using the analytical tools of Geographic Information Systems (GIS), shifting the research perspective away from individual mounds within a single archaeological site towards an entire cultural space encompassing over a dozen monumental cemeteries (Łuczak & Przybył 2012).

Methods and results

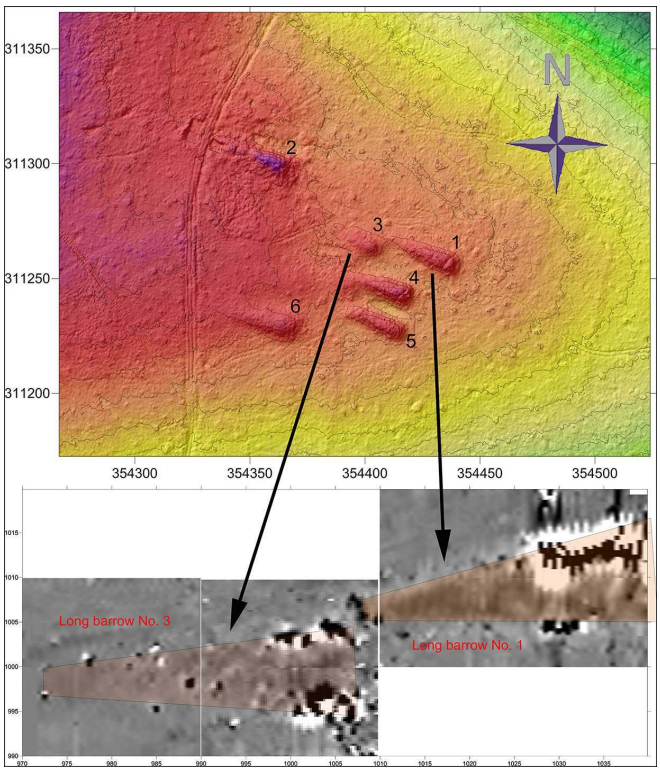
Stage one: traditional examination of long barrows within a single cemetery

13 The first stage of research in Muszkowice, conducted by the use of traditional methods of archaeological study, was initiated soon after the cemetery was accidentally discovered there. It consisted of three sub-stages:
- surface survey conducted at the site (sub-stage one) with the aim of documenting the spatial organisation of the cemetery;
- research excavation of barrow n° 2 (sub-stage two), and geomagnetic survey of barrows n^{os} 1 and 3 and trial trenching of barrow n° 3 (sub-stage three) – both of these were performed with the aim of identifying the method of construction of the barrows and the layout of their burial space as well as documenting any traces of activities that might have accompanied the burial rituals. In the course of the study, samples were collected for geological, paleobotanical and soil examination as well as for radiocarbon dating, allowing the dates of the cemetery's construction and use to be determined.

14 The first sub-stage, launched soon after the discovery of the cemetery to perform the necessary conservation activities, confirmed the presence of six archaeological features covered with elongated earthen mounds. They were occasionally accompanied by stones, the remains of stone enclosures of the barrows; these barrows were oriented along a SE–NW axis. The widest and highest parts of the features faced south-east, along the line of the downward slope on which they were situated. Barrow n° 2, the largest of the six, was located slightly higher than and at a short distance north-westwards from the rest, which were visibly clustered together (fig. 2). The initial measurements showed similar dimensions for four of the mounds (nos. 1, 4, 5 and 6), whose visible outlines fell within the range of 28.0–29.5 m in length and 7.0–7.7 m in width. The covering mound of barrow n° 2 reached approximately 36.0 m in length and 9.0 m in width at its front. In contrast, the mound of the smallest barrow, n° 3, was only 14.5 m in length and its width did not exceed 5.5 m (cf. Wojciechowski & Cholewa 2006: 227, fig. 2, 2011: 95, fig. 3).

2. Muszkowice, site 18. Digital Terrain Model (top) and the results of the geomagnetic prospection (bottom)

(Mirosław Furmanek, Agnieszka Przybył)



15 The second sub-stage spanned five excavation seasons, between 2001 and 2006, in the course of which the largest and best-preserved barrow, n° 2, was explored and documented (see Cholewa *et al.* 2003, Wojciechowski & Cholewa 2006, 2011, Wojciechowski *et al.* 2002). Spanning the two seasons between 2010 and 2011, the third sub-stage consisted of geophysical survey and trial trenching carried out on the smallest of the recorded features, i.e. barrow n° 3 (Furmanek & Przybył 2011). As the literature on the subject provides plenty of detailed information on the techniques of research excavation, surface survey and geophysical survey performed during the first stage of research in Muszkowice, their results are presented only briefly below (see Cholewa *et al.* 2003, Furmanek & Przybył 2011, Wojciechowski & Cholewa 2006, 2011, Wojciechowski *et al.* 2002).

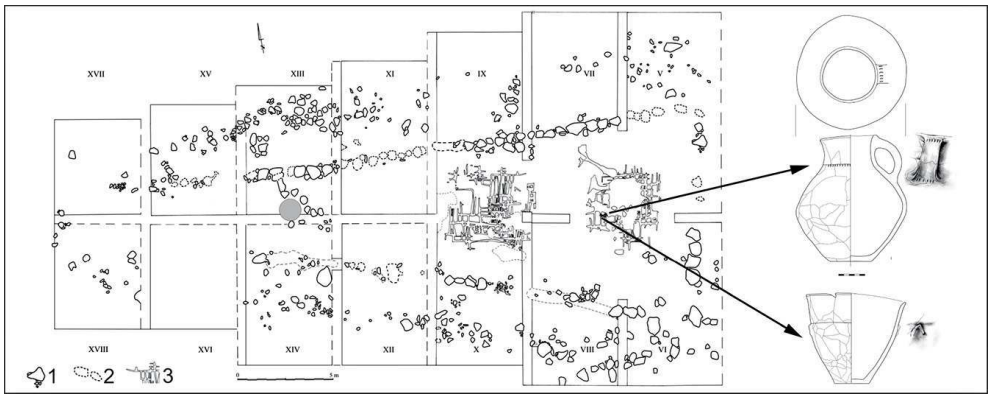
16 In the subsequent excavation seasons a total of approximately 1000 m^2 of the whole area covered by the monumental cemetery (7500 m^2) was explored. A similar area (1000 m^2) was designated within barrow n° 3 for geomagnetic prospection. Confirmed by trial trenching, the results of the prospection showed that, contrary to the researchers' earlier assumptions, the original dimensions of the barrow were in fact similar to those of the largest barrow, n° 2, and reached about 35.0 m in length and 1.0–9.0 m in width. Both barrows n° 2 and n° 3, the two features inspected in greatest detail during the first stage of research in Muszkowice, were reported to have had stone enclosures, with barrow n° 2 being additionally supported around its entire circumference by a frame built of untreated stone blocks. The enclosure of barrow n° 3 was preserved only in vestigial form. The stone material used for the construction of the barrows comprised 90% basalt and gneiss rocks, with the remaining 10% consisting mainly of granite.

17 Apart from the state of preservation, the covering mounds of both barrows differed also in their construction and internal spatial arrangement, as, although both barrows contained single graves located at their front parts, significant differences were found

between them with respect to the preparation of the place of interment. This place, indicated by an area of about18.0 m^2 (4.0 x 4.5 m) that was covered by streaks of dark soil, several centimetres wide and arranged in a crisscross pattern, was clearly visible in barrow n° 2 against the background of its yellow loess. The particular pattern and V-shaped cross section of the streaks indicated these traces had an anthropogenic origin. Furthermore, the claim that these were plough marks (also sometimes referred to as "ard marks" in the literature) intentionally made by humans was additionally supported by their central location at the front of the barrow and the discovery of a burial, placed directly over them, that contained characteristic grave goods – a funnel beaker with V-shaped plastic applications and a jug with stamp ornamentation (fig. 3). At a distance of 2.8 m towards the narrower end of the barrow, a similar area covered in plough marks was discovered, which, however, had no traces of a grave, nor did it hold grave inventory.

3. Muszkowice, site 18. Plan of the earthen long barrow n° 2. Legend: 1 – stones; 2 – traces of missing stones; 3 – plough/ard marks

(Nicole Lenkow)



18 In contrast, barrow n° 3 was found to have been characterised by a different arrangement. Even though it was placed along the main axis of the barrow and located at its front, as was the case described above, the grave of barrow n° 3 had the shape of a regular grave pit reaching 1.68 m in length and over 1.0 m in width. The pit's filling, over 0.4 m in depth, was deep black in colour, a characteristic which made it contrast sharply with the yellow loess background (fig. 4). No plough marks, human remains or grave inventory were found in the pit or its immediate vicinity.

4. Muszkowice, site 18. Grave pit under the mound of the earthen long barrow n° 3

(Agnieszka Przybył)

19 The burial mounds of both barrows were composed of dark humus soils that contrasted vividly with the yellow loess on which they were located. The mound of barrow n° 2 held over 600 fragments of FBC pottery, 240 flint artefacts and 8 stone artefacts, including pieces of a battleaxe, axe head and grinding slabs. Conversely, the trial trenches in barrow n° 3 revealed a surprisingly small number of severely damaged and fragmented pieces of pottery – merely a few. The results obtained during that stage of research also showed no remains of hearths or other archaeological features in the immediate vicinity of the two barrows examined in detail.

20 To sum up, the first stage of the study carried out in the Muszkowice Forest, which consisted of surface survey, research excavations and geophysical survey, produced data on the spatial organisation of the cemetery, the construction of the selected barrows and the activities that accompanied the burial rituals performed there. Additional samples were obtained for further analyses including, *inter alia*, the investigation of the chronology of the barrows discovered at the site. What was particularly significant at that time was that the contemporary state of research plainly disproved archaeologists' earlier arguments allegedly supporting the claim about the absence of earthen long barrows in south-western Poland. As was demonstrated, neither the type of soils available to build on, the distance from the nearest centres of already-identified barrows, nor the differences in the material cultures of their builders prevented the tradition of erecting such monumental structures from being successfully perpetuated. However, it must be emphasised at this point that the spatial perspective of the observations made was limited to a relatively small area of a single site and some of its features. Stage two of the research, conducted in Muszkowice by the use of modern methods of prospection, proved an excellent example of the possibilities offered by state-of-the-art technology to discover otherwise inaccessible features, a discovery which, in this particular case, considerably extended the field of observation, thus enriching the research perspective on the existence of earthen long barrows in south-western Poland.

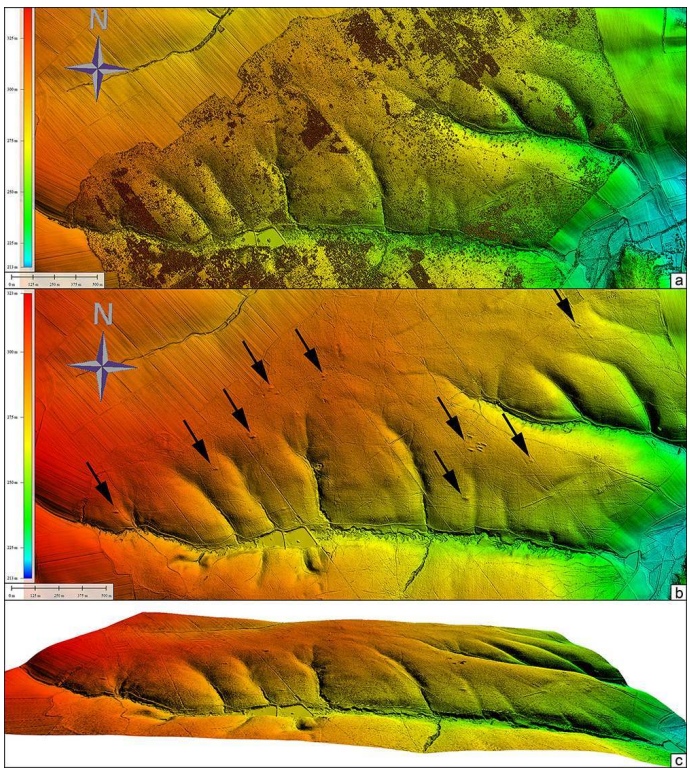
Stage two: modern examination of monumental cemeteries within the cultural landscape

21 In the spring of 2012 the second stage of research was launched in the Muszkowice Forest, intended to conduct, by the use of modern methods of non-invasive prospection, an in-depth analysis of the landscape setting of the cemetery located at site Muszkowice 18. The stage was further divided into three sub-stages, consisting of airborne laser scanning (LIDAR/ALS), a fieldwalking survey of all places with visible ground deformation, and geomagnetic prospection conducted on two selected archaeological sites, all of which delivered most interesting and surprising results.

22 The airborne laser scanning within the first sub-stage was performed in March 2012. The measurements were made by recording a full echo waveform with point density of four points per m^2. This produced data in the form of a three-dimensional point cloud (in the LAS format) that was subsequently processed using classification algorithms, as a result of which two models were generated: a Digital Surface Model (DSM), showing the generalised level of woodland canopy, and a Digital Terrain Model (DTM), mapping the surface of the ground (cf. Crutchley & Crow 2010: 11–13, Devereux *et al.* 2005). The latter model showed the precise location of all archaeological sites covered by mounds that were previously invisible beneath the vegetation (fig. 5).

5. Northern part of the Muszkowice Forest. a – Digital Surface Model; b – Digital Terrain Model with arrows indicating the location of earthen long barrows; c – 3D Digital Terrain Model

(Agnieszka Przybył)



23 The second sub-stage of the prospection consisted of a fieldwalking survey intended to confirm whether the ground deformations indicated by the DTM in fact represented

archaeological features or were rather contemporary or natural elements of the landscape, such as deformations created by a falling tree or produced in the course of clearance, etc. Moreover, the survey produced photographic documentation of the sites and allowed for their initial cultural and chronological classification to be performed. In light of the results provided by the earlier excavation examination, both the size and characteristic elongated shape of the mounds were interpreted as indicative of the man-made character of the barrows. That they were the work of Neolithic builders was additionally supported by the discovery of larger stones at the site, as such a presence in an area covered mostly by loess soils was unambiguously identified with human activity. The DTM, generated based on data provided by the laser scanning, showed almost every hill, clearly seen against the valleys of several watercourses, to have been crowned by a site with an earthen long mound. Apart from the cemetery located at site 18, this stage of research led to the discovery of 15 additional monumental cemeteries in the Muszkowice Forest, forming an extensive complex comprising a total of 26 earthen long barrows with preserved mounds. The shapes of the covering mounds explicitly showed that these were the remains of archaeological features that had initially had an elongated, trapezoidal outline. The barrows showed a varied state of preservation. Nine of the newly discovered sites contained single barrows, while three of them were each home to a pair of monuments. The remaining two cemeteries held three and six barrows. One of the sites contained two barrows with well-preserved covering mounds that were clearly visible above the ground. However, the DTM indicated the presence of three additional long barrows, whose mounds were no longer visible to the naked eye. It was for this reason that the site, designated as Muszkowice 48, was selected for geomagnetic prospection to be performed in the final sub-stage of field research.

24 The prospection was performed using a Bartington Grad 601-2 gradiometer on two sites: Muszkowice 48 and also Muszkowice 25, a newly-discovered cemetery with six barrows. The survey covered a total area of 2,700 m^2. The measurements were performed with a resolution of 0.1 nT, recording data at intervals of 0.25 m along measurement lines spaced 1 m apart. Due to the unfavourable lie of the land and the presence of dense vegetation impeding the survey, the data was acquired as a set of point readings rather than in continuous mode. The analysis of fluctuations in the magnetic field was conducted by the use of ArcheoSurveyor software (v. 2.5.16.0; Furmanek *et al.* 2012). The primary aim of this sub-stage of research was to confirm the hypothesis of the anthropogenic origin of the mounds without having to actually excavate them. The existence of magnetic anomalies, which showed the presence of elements of stone structures, was interpreted as a positive association of the barrows with the monumental funerary tradition of the FBC. The prospection revealed such anomalies to result from the presence of stones forming roughly regular clusters and patterns of lines. The space enclosed by the stones showed increased magnetic field strength, a fact that was interpreted to indicate the presence of soil layers accumulated in the process of erecting the covering mounds, currently invisible to the naked eye.

25 The final sub-stage of the research also consisted of developing a detailed documentation of the sites and conducting a series of spatial analyses by the use of GIS software (including Global Mapper 13.2, ArcGIS 9.3), activities that were aimed at recognising how the location of the barrows was influenced by the local environment. This, in turn, allowed the researchers to explore the landscape setting of the monumental cemeteries in the Muszkowice Forest (cf. Łuczak & Przybył 2012). The results of these analyses

revealed the location of the barrows to follow a number of key principles:
- locating the barrows in spots that were exposed and occupied the highest parts of the hills or their hillsides;
- preference for hillsides facing south and south-east;
- locating each barrow along a NW–SE or W–E axis;
- positioning the highest parts of the monuments facing south or south-east.

26 The same analyses also showed no uniform pattern of barrow distribution within particular cemeteries.

27 To sum up, the second stage of research in Muszkowice, carried out by the use of modern methods of non-invasive prospection, delivered a variety of significant, as much as surprising, results. Firstly, the airborne laser scanning of an area that had previously been unavailable due to dense woodland vegetation led to the startling discovery of over a dozen new monumental cemeteries. Its most significant outcome was that the former hypothesis assuming the unique and isolated character of the Muszkowice 18 cemetery was disproved, showing it to be a part of a larger complex manifesting the monumental funerary tradition in that part of the country. Secondly, the use of modern measurement techniques allowed the researchers to pinpoint the location of all sites and prepare conservation documentation without the need to perform time-consuming and expensive geodetic surveys of a very inaccessible area. Thirdly, the use of the latest developments of technology made it possible to mark the sites for geomagnetic survey with precision and, in consequence, to confirm the anthropogenic origin of the mounds and their association with the monumental funerary tradition of the FBC. Finally, and most importantly from the perspective of this paper, the use of modern methods of non-invasive prospection greatly contributed to shifting the spatial perspective of observation: from one limited to a small area of a single site to one encompassing the entire complex of monumental cemeteries. As is shown in the final part of this paper, this extended field of observation resulted in expanding the research perspectives as well, since the use of GIS analytical tools allowed the researchers to extend the focus of their investigation to encompass the entire cultural landscape within which the cemeteries were located. As a consequence of using these new methods of archaeological investigation, a far-reaching change was made to the research perspective on the issue of earthen long barrows in south-western Poland, offering as a result a wholly new interpretation of cultural phenomena associated with the spread of the monumental funerary tradition in Europe.

Discussion

28 The case of research conducted in Muszkowice was the first such study in Poland where the technique of airborne laser scanning was employed to analyse the landscape setting of FBC earthen long barrows. It is a representative example of how a change in research approach, away from traditionally used methods of archaeological investigation in favour of the use of modern methods of non-invasive prospection, created entirely new perspectives for further research. As has been demonstrated above, the previously held assumptions about the presumed absence of long barrows in south-western Poland were challenged as early as stage one of the research (cf. Bukowska-Gedigowa 1975, Wojciechowski & Cholewa 2006). As much as they contributed to the analysis of selected barrows, however, the traditional methods of examination did not provide satisfactory answers to a number of important questions: for instance, it still remains unknown why

the mounds located in immediate proximity to each other differed so substantially with respect to their internal spatial arrangement and inventory, why the barrows varied in form, or what their precise chronology was.

29 Furthermore, owing to the researchers' recognition of the Muszkowice cemetery as an isolated expression of the monumental funerary tradition in that part of the country, they limited their questions to the issues concerning the spatial organisation and chronology of the barrows, taking no consideration of the landscape setting in which the cemetery was situated. The archaeologists who first explored the site accepted the view that the barrows must have been erected by a small community of representatives of the FBC's Eastern Group who had migrated to Lower Silesia from the territories of Kujavia in central Poland (Wojciechowski & Cholewa 2006, 2011). As a consequence of that assumption, the cemetery discovered in the Muszkowice Forest was hailed as a rare exception – not a manifestation of a greater cultural phenomenon, but a mere incident of marginal importance on the global scale of phenomena related to the tradition of erecting long barrows. It was only the results of the large-scale non-invasive prospection carried out in stage two of the research that disproved that thesis and revealed the cemetery to be just one of over a dozen such sites there. Unearthing a whole complex of monumental cemeteries encouraged the researchers to reconsider their view on the presence of earthen long barrows in the Sudeten Foreland and acknowledge the significance of that discovery for the general interpretation of the processes which led to the dissemination of the monumental funerary tradition in Europe.

30 It is worth pointing out that, in her first book on the North European earthen long barrows, Magdalena S. Midgley – the pre-eminent expert in the subject – observed that "[t]he distribution of large-scale funerary monuments in Europe reveals that this phenomenon is associated with areas peripheral to the primary temperate European Neolithic settlement (LBK culture)" (Midgley 1985: 199). She restated this claim in another book devoted to monumental cemeteries:

(...) the monumental cemeteries – conglomerations of a dozen or more barrows – make a highly significant appearance on the periphery of the disintegrating Danubian world: in the regions of Kujavia and Western Pomerania, in France on the Plaine de Caen, along the river valleys of the Yonne and Seine, and possibly also in Moravia. These are precisely the areas of intensive cultural contacts between the indigenous hunter-gatherers and the Danubian farmers, and here the barrow cemeteries constitute a prelude to the monumentality of the Neolithic funerary tradition (Midgley 2005: 80–81).

31 Running contrary to these statements, the initial examination of Muszkowice 18, subsequently supported by the results of the large-scale non-invasive prospection, demonstrated that the entire complex of cemeteries was located on fertile loess soils, the type of soils that had been intensively settled by the early Neolithic Danubian communities (cf. Jankowska 1999, Kulczycka-Leciejewiczowa 1993). This surprising location of the cemeteries – situated, not on the periphery of the former Linear Pottery culture (LBK) settlement, but in its centre – showed that the earlier assumption that such sites were absent in areas of key importance to early agrarian communities merely reflected the contemporary state of research, rather than resulted from local FBC communities actually abandoning the tradition of erecting long barrows. It follows that one of the major accomplishments of the study conducted in Muszkowice was to prove the need to take account of the possibility that the tradition of erecting earthen long barrows might in fact have been much wider in scope than was previously thought. The

discoveries made in Lower Silesia clearly demonstrate that the monumental concept of Neolithic builders spread not only to the north of Europe but also to the southern areas that had not previously been given consideration – the loess territories lying south of the North European Plain (see, e.g., Sherratt 1990). This hypothesis is additionally supported by the findings from south-eastern Poland and central Germany (Frase *et al.* 2014, Kossian 2005, Król 2011, Libera & Tunia 2006, Schwartz 2003).

32 As has been mentioned above, the wide scope of non-invasive prospection proved effective in obtaining a new set data which, in turn, made it possible to change the perspective of observation: detailed elevation data allowed the researchers to use GIS statistical tools in successfully exploring the following aspects of the landscape setting:
- preferences for location for building the cemeteries;
- the placing of the cemeteries within the broader context of particular elements of the landscape, such as streams and watercourses, or sites that were boggy or exposed to a lot of sun;
- the location of the cemetery complex relative to FBC settlements.

33 The investigation of the Muszkowice cemeteries also produced a final answer to the question of whether the Lower Silesian monuments were a manifestation of the Central European funerary tradition, or rather its local variant related to the tradition of barrows from Moravia. The results of analyses confirmed that the principles for locating the features generally correspond to those observed in other areas where FBC monuments are present, for instance in Kujavia, Western Pomerania and Mecklenburg (cf. Jankowska 1999, Midgley 1985, 2008, Zych 2002, 2006). It is justifiable to assume that the area of Muszkowice was chosen for erecting the barrows because of the unique lie of the land, resulting primarily from a considerable geomorphological variety of the clearly distinguishable natural complex of hills. The area's exceptional characteristics, especially visible when compared with neighbouring areas, are also associated with numerous streams and brooks flowing through its deep valleys. Rendering the Muszkowice Forest a most suitable location for building monumental cemeteries was the additional advantage of the close proximity of freshwater seepage areas and springs, and the peaty bottoms of its valleys, characteristics probably having deep symbolic significance. As is the case here, barrows located in spots that are clearly seen from a distance, on "elevations surrounded by boggy, marshy areas, or in close proximity to water" (Midgley 2008: 12, see also Adamczak 2013), have also been found across the North European Plain.

34 Similar principles of locating barrows have also been observed in Moravia, although it must be borne in mind that the Moravian cemeteries are home to a significantly larger number of features: on average, they include between 20 and 30 barrows each (Šmíd 2003, 2006). In contrast, as is the case of barrows discovered in Schleswig-Holstein, Denmark and Sweden, those in the Muszkowice Forest generally occur singly and in pairs, only occasionally forming larger clusters of five or six monuments, which is another similarity with the cemeteries of the North European Plain (cf. Midgley 2008: 12). What is more, the Lower Silesian features differ from those present in Moravia with respect to the ratio of length to width and the shape of their mounds, which are distinctly oval in the latter case, as well as to the construction of the barrows and the burial mounds, including the presence of cairn-covered rectangular stone cists and rectangular stone kerbs. Finally, the most significant difference between the barrows discovered in the two areas lay in the funeral rite, which, in the case of Moravia, with the exception of its oldest surviving monuments, was definitely based on cremation (Šmíd 2003, 2006).

35 All of these findings ultimately confirm that, contrary to researchers' previous expectations about a potential presence of the Moravian type of barrows in the Sudeten Foreland, the monuments found in the Muszkowice Forest are representative of the Kujavian type, one that is characteristic of the areas lying to the north of Lower Silesia (cf. Bukowska-Gedigowa 1975, Jankowska 1999). This observation is additionally supported by the fact that, whereas characteristic plough marks were discovered under the covering mound of barrow n° 2 at the site of Muszkowice 18, showing marked similarities with the monuments from the North European Plain, no such marks have ever been recorded under the Moravian mounds. It is worth emphasising once again that in the case of the Muszkowice barrow both the characteristics and the location of the ard marks leave no room for doubt that these marks were made intentionally for burial purposes (cf. e.g. Kristiansen 1990, Midgley 2008, Rausing 1988, Rowley-Conwy 1987).

36 The above conclusions confirm the hypothesis that the FBC tradition of erecting earthen long barrows also spread southwards, arriving in the Sudeten Foreland in an only slightly altered form, with the most noticeable difference between the Kujavian monuments and the barrows discovered in Muszkowice manifesting in the slightly smaller size of the covering mounds of the latter. Conversely, the oval barrows from Moravia, only briefly characterised here, represent a substantially modified variation on the original North European Plain monuments. As such, they probably constitute a more distant reminder of the monumental funerary tradition.

Conclusions

37 Going beyond commonly accepted research procedures, which focus primarily on studying the material remains of cultural processes within single archaeological sites and features, offers the advantage of a wholly new perspective on prehistoric phenomena, one that takes account of the entire social space of a particular cultural landscape. In Lower Silesia, as is often the case elsewhere, the complete archaeological examination of the area was hindered by the presence of woodland. As was demonstrated by the research conducted in the Muszkowice Forest, the disadvantageous impact of this element of the environment can successfully be eliminated by the use of modern techniques of remote sensing. In this case, they allowed the researchers to use GIS tools and shift the perspective of their investigation away from single sites towards a more broadly defined cultural landscape. As a consequence, they were able to move the research focus from taxonomic and chronological aspects of single earthen long barrows to those related to the social functioning of the cemeteries in a particular cultural setting.

38 The wider use of modern techniques of remote sensing is doubtless limited by its high cost. However, new possibilities of obtaining LIDAR/ALS data without the necessity of conducting expensive flights have recently opened up in Poland due to the results being made available of the 2009–2013 EU-funded ISOK project (the IT system of the country's protection against extreme hazards). Polish archaeologists are now given free access to one of the largest geospatial databases in Europe, which collects data in the form of a classified point cloud (LAS 1.2 format) and DSM and DTM models. Similar projects are also underway in other countries of Europe, a fact which may indicate the beginning of a new, highly promising stage of research conducted particularly in forested areas that do not easily yield to archaeological investigation.

39 The results of the study carried out in Muszkowice have convincingly demonstrated that using the latest developments of technology still allows us to make unexpected discoveries that may shed new light on issues related to the global cultural phenomena of the Neolithic. This pertains both to phenomena that have yet to be explored and to those that we thought we already understood. The research, particularly in stage two, has also shown that using several complementary methods of archaeological examination brings the most fruitful results in the form of new discoveries that allow us to enhance the perspective of our exploration and significantly further our understanding of the past.

40 **Acknowledgements.** The project called *The Non-invasive Prospection of the Earthen Long Barrow Sites in Muszkowice* was carried out in 2012 by the Institute of Archaeology at the University of Wrocław, with the financial support of the Polish Ministry of Culture and National Heritage within the Cultural Heritage programme priority "Protection of Archaeological Sites" (Project No. 1409/12/FPK/NID). I thank all students and those involved in this project. I also thank the reviewers and the editors for their valuable and constructive comments on the previous version of this paper. And my special thanks go to Jarosław A. Szymański, my friend and translator, for his most valuable support, helpful comments and particularly useful discussions which helped shape the current version of this article.

BIBLIOGRAPHIE

Adamczak 2013, ADAMCZAK K., Communities of the Funnel Beaker Culture During the Era of Erecting Monumental Tombs in the Territory of Poland: Rituals, Vessels and Social Divisions, *in: From Funeral Monuments to Household Pottery. Current advances in Funnel Beaker Culture (TRB/TBK) research. Proceedings of the BorgerMeetings 2009, The Netherlands*, Bakker J.A., Bloo S.B.C., Dütting M.K. (Dir.), Oxford, Archaeopress, 2013, p. 177-193 (British archaeological Reports - International Series; 2474).

Bukowska-Gedigowa 1975, BUKOWSKA-GEDIGOWA J., Kultura pucharów lejkowatych w dorzeczu górnej Odry (Die Trichterbecherkultur im Flussgebiet der Oberen Oder), *Przegląd Archeologiczny*, Wrocław, 23, 1975, p. 83-186.

Cholewa *et al.* 2003, CHOLEWA P., WOJCIECHOWSKI W., LIMISIEWICZ A., Drugi sezon badań wykopaliskowych na megalitycznym cmentarzysku kultury pucharów lejkowatych w Muszkowicach stan. 18, pow. Ząbkowice Śląskie, *Śląskie Sprawozdania Archeologiczne*, Wrocław, 45, 2003, p. 119-124.

Cowley 2011, COWLEY D.C. Ed., *Remote sensing for archaeological heritage management: proceedings of the 11th EAC Heritage Management Symposium, Reykjavík, Iceland, 25-27 March 2010*, Brussel, Europae Archaeologiae Consilium, 2011, 312 p. (EAC occasional paper; 5 / Occasional Publication of the Aerial Archaeology Research Group; 3).

Crow *et al.* 2007, CROW P., DEVEREUX B.J., AMABLE G.S., Woodland vegetation and its implications for archaeological survey using LiDAR, *Forestry*, London, 80, 3, 2007, p. 241-252.

Crow [2012], CROW P., Historic Environment Surveys of woodland using LiDAR, *Forest Research*, s.l., http://www.forestresearch.gov.uk/lidar/, [2012].

Crutchley & Crow 2010, CRUTCHLEY S., CROW P., *The Light Fantastic: Using airborne laser scanning in archaeological survey*, Swindon, English Heritage, 2010, 43 p.

Devereux *et al.* 2005, DEVEREUX B.J., AMABLE G.S., CROW P., CLIFF A.D., The potential of airborne lidar for detection of archaeological features under woodland canopies, *Antiquity*, Oxford, 79, 305, 2005, p. 648-660.

Doneus *et al.* 2008, DONEUS M., BRIESE C., FERA M., JANNER M., Archaeological prospection of forested areas using full-waveform airborne laser scanning, *Journal of Archaeological Science*, London, 35, 2008, p. 882-893.

Doneus & Briese 2011, DONEUS M., BRIESE C., Airborne Laser Scanning in forested areas – potential and limitations of an archaeological prospection technique, *in: Remote sensing for archaeological heritage management: proceedings of the 11th EAC Heritage Management Symposium, Reykjavík, Iceland, 25-27 March 2010*, Cowley D.C. (Dir.), Brussel, Europae Archaeologiae Consilium, 2011, p. 59-76 (EAC occasional paper; 5 / Occasional Publication of the Aerial Archaeology Research Group; 3).

Frase *et al.* 2014, FRASE J., VEIT U., HEYNOWSKI R., SEIFERT G., STROBEL M., VOGT R., Grabenwerke und trapezförmige Grabanlagen im Raum Riesa – eine Siedlungslandschaft des 4. Jahrtausends v.Chr. an der östlichen Peripherie der Baalberger Kultur, *Tagungen des Landesmuseums für Vorgeschichte*, Halle, 11, 2014, p. 1-12.

Furmanek & Przybył 2011, FURMANEK M., PRZYBYŁ A., Wyniki wstępnej prospekcji geomagnetycznej cmentarzyska megalitycznego kultury pucharów lejkowatych w Muszkowicach, woj. dolnośląskie, *in: Metody geoinformacyjne w badaniach archeologicznych*, Jasiewicz J., Lutyńska M., Rzeszewski M. *et al.* (Dir.), Poznań, Bogucki Wydawnictwo Naukowe, 2011, p. 25-26 (Środowisko i kultura; 9).

Furmanek *et al.* 2012, FURMANEK M., MACKIEWICZ M., GRZEŚKOWIAK M., *Wyniki prospekcji geomagnetycznej na terenie Lasu Muszkowickiego przeprowadzonej w 2012 r.*, Manuscript in the Archive of the Institute of Archaeology - University of Wrocław, Wrocław, 2012.

Jankowska 1999, JANKOWSKA D., Megalithic und kujawische Gräber, *in: Studien zur Megalithik. Forschungsstand und ethnoarchäologische Perspektiven: The Megalithic Phenomenon. Recent Research and Ethnoarchaeological Approaches*, Beinhauer K.-W., Cooney G., Guksch C.E. *et al.* (Dir.), Mannheim/ Weissbach, Beier & Beran, 1999, p. 215-226.

Kossian 2005, KOSSIAN R., *Nichtmegalithische Grabanlagen der Trichterbecherkultur in Deutschland und den Niederlanden*, Halle, Landesamt für Denkmalpflege und Archäologie Sachsen-Anhalt / Landesmuseum für Vorgeschichte, 2005, 826 p. (Veröffentlichungen des Landesamtes für Denkmalpflege und Archäologie Sachsen-Anhalt - Landesmuseum für Vorgeschichte; 58).

Kristiansen 1990, KRISTIANSEN K., Ard marks under barrows: a response to Peter Rowley-Conwy, *Antiquity*, Oxford, 64, 243, 1990, p. 322-327.

Król 2011, KRÓL D., *Chamberless Tombs in Southeastern Group of Funnel Beaker Culture*, Rzeszów, Fundacja Rzeszowskiego Ośrodka Archeologicznego, 2011, 124 p. (Collectio Archaeologica Ressoviensis; 17).

Kulczycka-Leciejewiczowa 1993, KULCZYCKA-LECIEJEWICZOWA A., *Osadnictwo neolityczne w Polsce południowo-zachodniej*, Wrocław, Instytutu Archeologii i Etnologii PAN, 1993, 223 p.

Libera & Tunia 2006, LIBERA J., TUNIA K. Eds., *Idea megalityczna w obrzĄdku pogrzebowym kultury pucharów lejkowatych*, Lublin / Kraków, Instytut Archeologii i Etnologii PAN, 2006, 438 p.

Łuczak & Przybył 2012, ŁUCZAK A., PRZYBYŁ A., *Analizy przestrzenne megalitów kultury pucharów lejkowatych w Lesie Muszkowickim. Analiza uwarunkowań środowiskowych lokalizacji obiektów archeologicznych z zastosowaniem GIS*, Manuscript in the Archive of the Institute of Archaeology - University of Wrocław, Wrocław, 2012.

Midgley 1985, MIDGLEY M.S., *The Origin and Function of the Earthen Long Barrows of Northern Europe* , Oxford, Archaeopress, 1985, 330 p. (British archaeological Reports - International Series; 259).

Midgley 2005, MIDGLEY M.S., *The Monumental Cemeteries of Prehistoric Europe*, Stroud, Tempus, 2005, 159 p. (Revealing history).

Midgley 2008, MIDGLEY M.S., *The megaliths of Northern Europe*, London, Routledge, 2008, 225 p.

Opitz & Cowley 2013, OPITZ R., COWLEY D.C. Eds., *Interpreting archaeological topography: airborne laser scanning, 3D data and ground observation*, Oxford, Oxbow Books, 2013, 268 p. (Occasional publication of the Aerial Archaeology Research Group; 5).

Przybył s.p., PRZYBYŁ A., Badania nieinwazyjne w ochronie dziedzictwa archeologicznego terenów zalesionych na przykładzie Lasu Muszkowickiego, *Fontes Archaeologici Posnanienses*, Poznán, 50, s.p.

Rausing 1988, RAUSING G., More on the ard marks, *Antiquity*, Oxford, 62, 235, 1988, p. 285-.

Rowley-Conwy 1987, ROWLEY-CONWY P., The interpretation of ard marks, *Antiquity*, Oxford, 61, 232, 1987, p. 263-266.

Rzepecki 2011, RZEPECKI S., *The roots of megalithism in the TRB culture*, Łódź, Fundacja Uniwersytetu Łódzkiego, 2011, 251 p.

Schwartz 2003, SCHWARTZ R., *Pilotstudien : zwölf Jahre Luftbildarchäologie in Sachsen-Anhalt* Halle, Landesamt für Archäologie Sachsen-Anhalt / Landesmuseum für Vorgeschichte in Halle, 2003, 290 p.

Sherratt 1990, SHERRATT A., The genesis of megaliths: monumentality, ethnicity and social complexity in Neolithic north-west Europe, *World Archaeology*, London, 22, 2, 1990, p. 147-167.

Šmíd 2003, ŠMÍD M., *Mohylová pohřebiště kultury nálevkovitých* pohárů *na Moravě*, Brno, Ustav archeologické památkové péče Brno, 2003, 246 p. (Pravek. Supplementum; 11).

Šmíd 2006, ŠMÍD M., Morawskie cmentarzyska kurhanowe kultury pucharów lejkowatych, *in: Idea megalityczna w obrzĄdku pogrzebowym kultury pucharów lejkowatych*, Libera J., Tunia K. (Dir.), Lublin / Kraków, Instytut Archeologii i Etnologii PAN, 2006, p. 197-224.

Wiślański 1979, WIŚLAŃSKI T., Kształtowanie siĘ miejscowych kultur rolniczo-hodowlanych. Plemiona kultury pucharów lejkowatych, *in: Prahistoria Ziem Polskich. Vol. II. Neolit*, Hensel W. (Dir.), Wrocław / Warszawa / Kraków / Gdańsk, Zakład Narodowy im. Ossolińskich, 1979, p. 165-260.

Wojciechowski 1981, WOJCIECHOWSKI W., Die Synchronisierung der Spätphase der Trichterbecherkultur in Nizina Śląska mit deren Lokalgruppen in Südwestpolen und den angrezenden Gebieten, *Jahresschrift für mitteldeutsche Vorgeschichte*, Halle, 63, 1981, p. 121-128.

Wojciechowski 1991, WOJCIECHOWSKI W., Die Trichterbecherkultur in der Lößzone von Niederschlesien, *in: Die Trichterbecherkultur: Neue forschungen und Hypothesen. Teil II*, Jankowska D. (Dir.), Poznań, Instytut Prahistorii Uniwersytetu im. Adama Mickiewicza, 1991, p. 87-93.

Wojciechowski *et al.* 2002, WOJCIECHOWSKI W., CHOLEWA P., LIMISIEWICZ A., Wyniki rozpoznania terenowego i badań wykopaliskowych megalitycznego grobowca kujawskiego w rejonie Henrykowa, pow. Ząbkowice Śląskie, *Śląskie Sprawozdania Archeologiczne*, Wrocław, 44, 2002, p. 177-186.

Wojciechowski & Cholewa 2006, WOJCIECHOWSKI W., CHOLEWA P., Grobowce kujawskie kultury pucharów lejkowatych na Dolnym Śląsku, *in: Idea megalityczna w obrzĄdku pogrzebowym kultury pucharów lejkowatych*, Libera J., Tunia K. (Dir.), Lublin / Kraków, Instytut Archeologii i Etnologii PAN, 2006, p. 225-233.

Wojciechowski & Cholewa 2011, WOJCIECHOWSKI W., CHOLEWA P., Grobowce megalityczne u podnóża Sudetów, *in: Kurhany i obrzĄdek pogrzebowy w IV-II tysiĄcleciu p.n.e.*, Kowalewska-Marszałek H., Włodarczak P. (Dir.), Kraków / Warszawa, Instytut Archeologii i Etnologii PAN, 2011, p. 91-107.

Zych 2002, ZYCH R., *Wielkie domostwa i grobowce typu kujawskiego w kulturze symbolicznej neolitu na ziemiach polskich*, Rzeszów, Instytut Archeologii Uniwersytetu Rzeszowskiego, 2002, 87 p.

Zych 2006, ZYCH R., Organizacja przestrzeni miejsc z grobowcami kujawskimi i jej symbolika, *in: Idea megalityczna w obrzĄdku pogrzebowym kultury pucharów lejkowatych*, Libera J., Tunia K. (Dir.), Lublin / Kraków, Instytut Archeologii i Etnologii PAN, 2006, p. 117-126.

RÉSUMÉS

La découverte en 1995, dans la forêt de Muszkowice, dans le sud-ouest de la Pologne, d'une nécropole monumentale de la culture des gobelets en entonnoir, comprenant 6 longs tumulus de terre, était totalement inattendue. À l'issue d'une reconnaissance détaillée, utilisant des méthodes de recherche traditionnelles, cette nécropole avait été considérée comme le seul monument funéraire de ce type dans cette partie de la Pologne. Depuis, la réalisation d'une prospection à large échelle utilisant la technologie scanner LIDAR/ALS a conduit à la découverte de 15 nécropoles monumentales supplémentaires comprenant 20 longs tumulus. L'article montre que, même après une reconnaissance détaillée et fructueuse, par la prospection de surface, la détection géomagnétique et des fouilles, la mise en œuvre de nouvelles technologies de prospection peut apporter des résultats surprenants et élargit largement l'état des connaissances : elle permet des découvertes inattendues de monuments inconnus auparavant et, par l'apport de nouvelles données, elle ouvre de nouvelles perspectives de recherche, qui ouvrent de nouvelles possibilités d'interprétation des caractéristiques culturelles connues jusqu'à présent.

A surprising discovery was made in 1995 in the Muszkowice Forest, south-western Poland, of a monumental cemetery with 6 earthen long barrows of the Funnel Beaker culture. Following an in-depth examination using traditional methods of archaeological survey, the cemetery was hailed as the only such funerary feature in that part of the country. However, subsequent large-area prospection performed using airborne laser scanning led to a startling discovery of further 15 monumental cemeteries with a total of 20 earthen long barrows. This article shows that even following a very fruitful examination conducted using surface survey, excavation and geomagnetic prospection, the employment of modern methods of non-invasive prospection may still deliver unexpected results that enhance our knowledge: they help discover unknown features and, by producing new data, extend the research perspectives, thus creating new possibilities for interpreting the cultural phenomena of the past.

INDEX

Mots-clés : Sud ouest de la Pologne, Muszkowice, Néolithique, longs tumulus de terre, nécropoles monumentales, tradition funéraire monumentale, culture des gobelets en entonnoir, prospection non destructive, LIDAR/ALS, paysage culturel
Keywords : South-western Poland, Muszkowice, Neolithic, earthen long barrows, monumental cemeteries, monumental funerary tradition, Funnel Beaker culture, non-invasive prospection, LIDAR/ALS, cultural landscape

AUTEUR

AGNIESZKA PRZYBYŁ

Institute of Archaeology, University of Wroclaw, Szewska 48, 50-139 Wrocław, Poland — agnieszka.przybyl@archeo.uni.wroc.pl